

Peroxy Radical Measurements aboard the P3-B during TRACE-P

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- Instrument Description
 - Principles of operation
 - Recent laboratory experiments
- TRACE-P data overview
- Steady-State Model
 - Principles
 - Examples from TOPSE

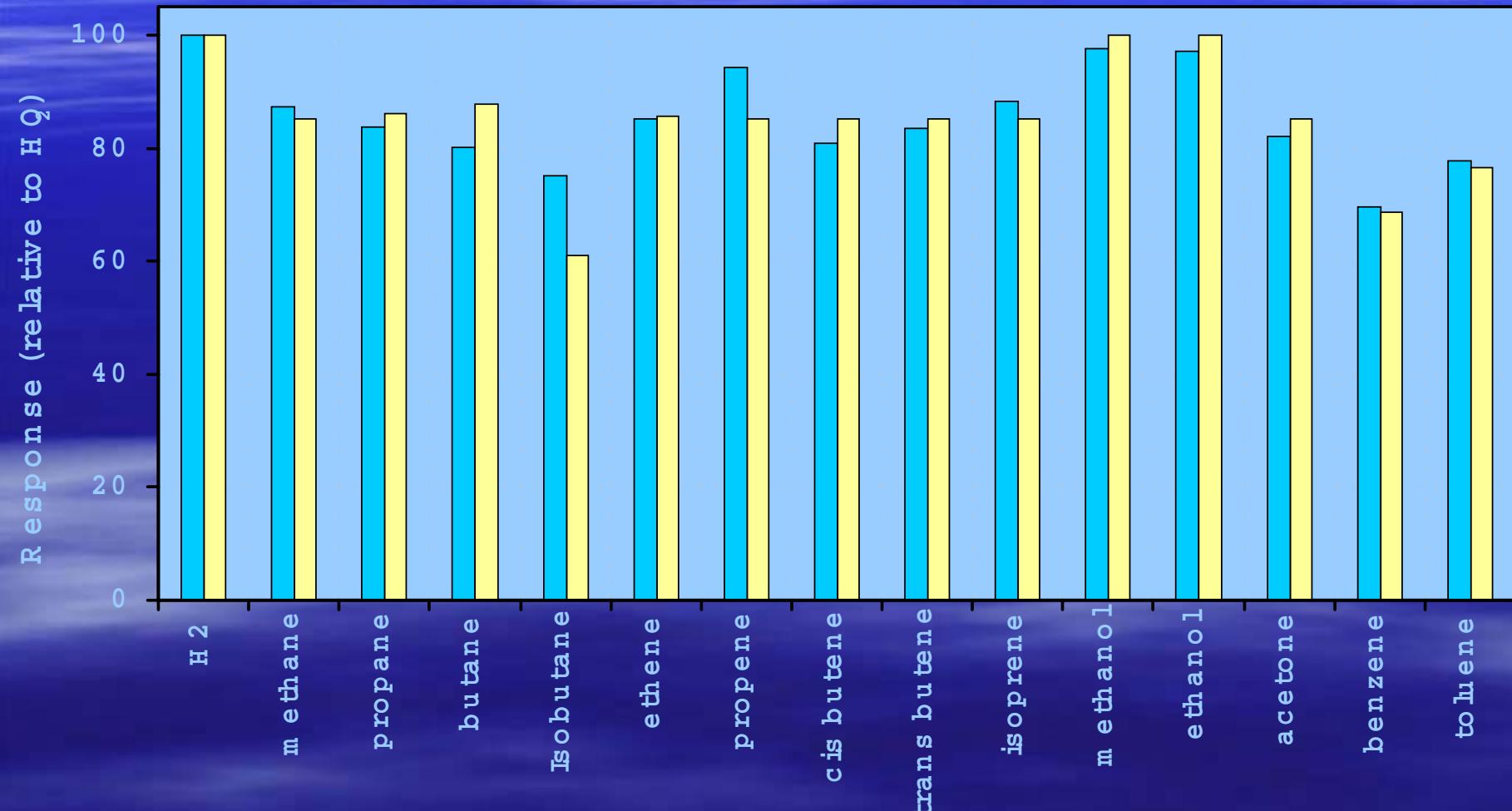
PerCIMS Peroxy Radical Measurement

- HO_2 and RO_2 are converted to H_2SO_4 in the instrument inlet by adding NO and SO_2^-
- H_2SO_4 is ionized by reaction with NO_3^-
- Low NO and SO_2 (6 and 300 ppmv) yields $[\text{HO}_2 + \text{S}(\text{RO}_2)] = [\text{HO}_x\text{RO}_x]$
- High NO and SO_2 (0.25 and 5% v/v) yields $[\text{HO}_2]$
- ***We are looking into a N_2 or O_2 dilution scheme that would not require pure NO or SO_2 , and could potentially allow rapid back-to-back HO_2 and HO_xRO_x measurements

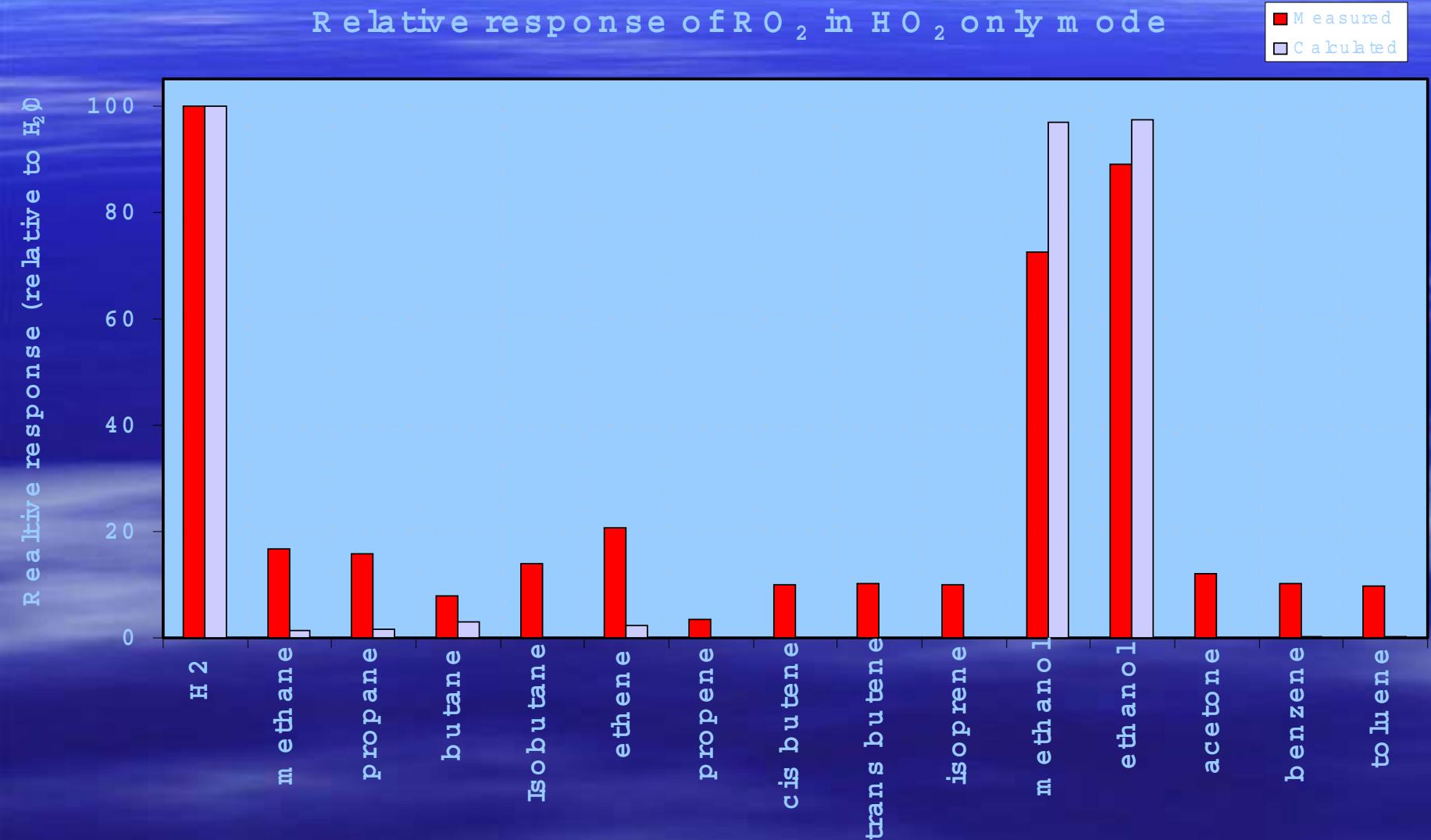
Response of PerCIMS to RO₂ radicals

Relative response of RO₂ radicals in HO₂+RO₂ mode

Measured
Calculated

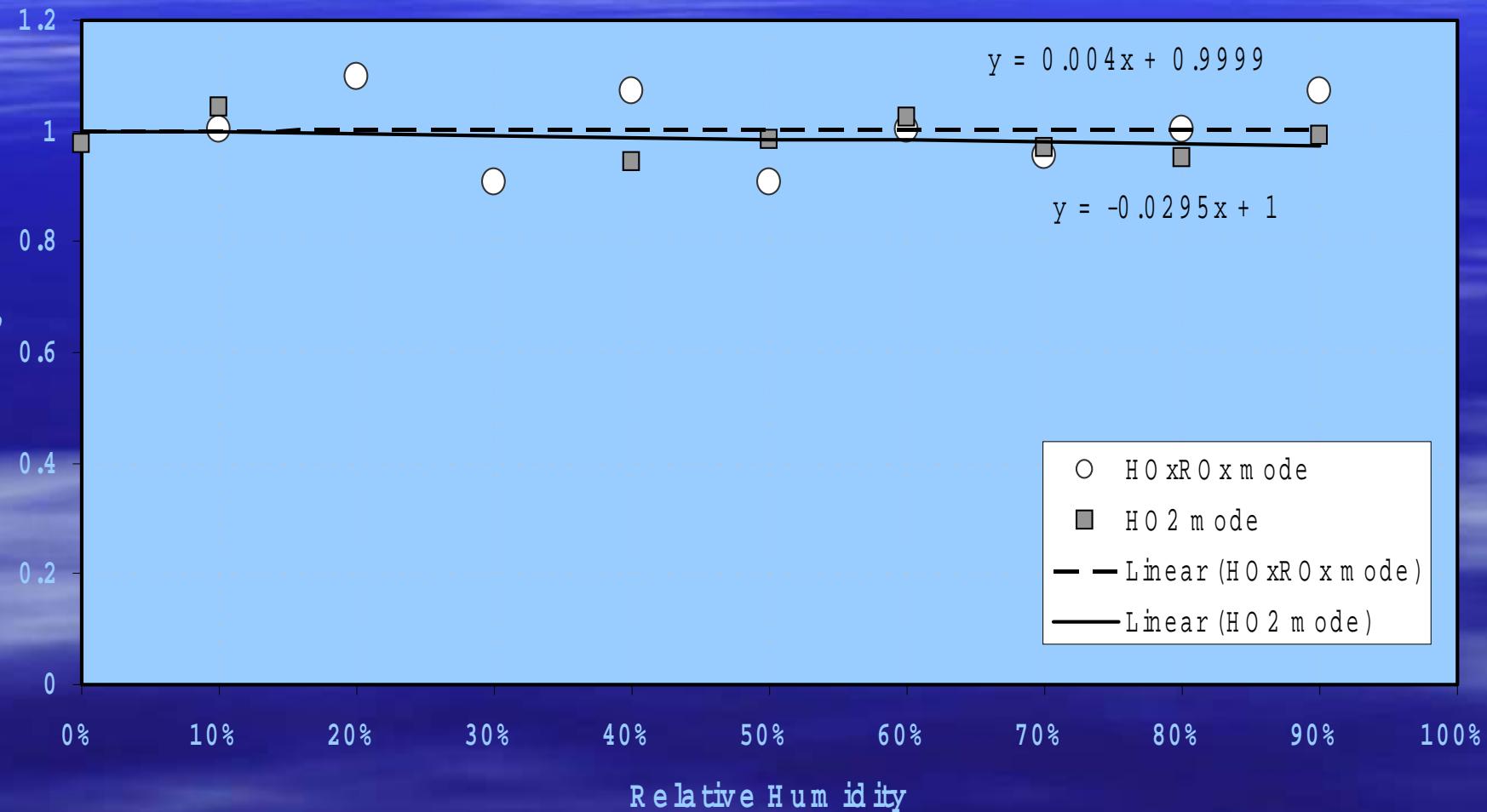


Response of PerCIMS to RO₂ (cont)



Humidity Effect on PerCIMS

Relative Signal Dependence on Humidity

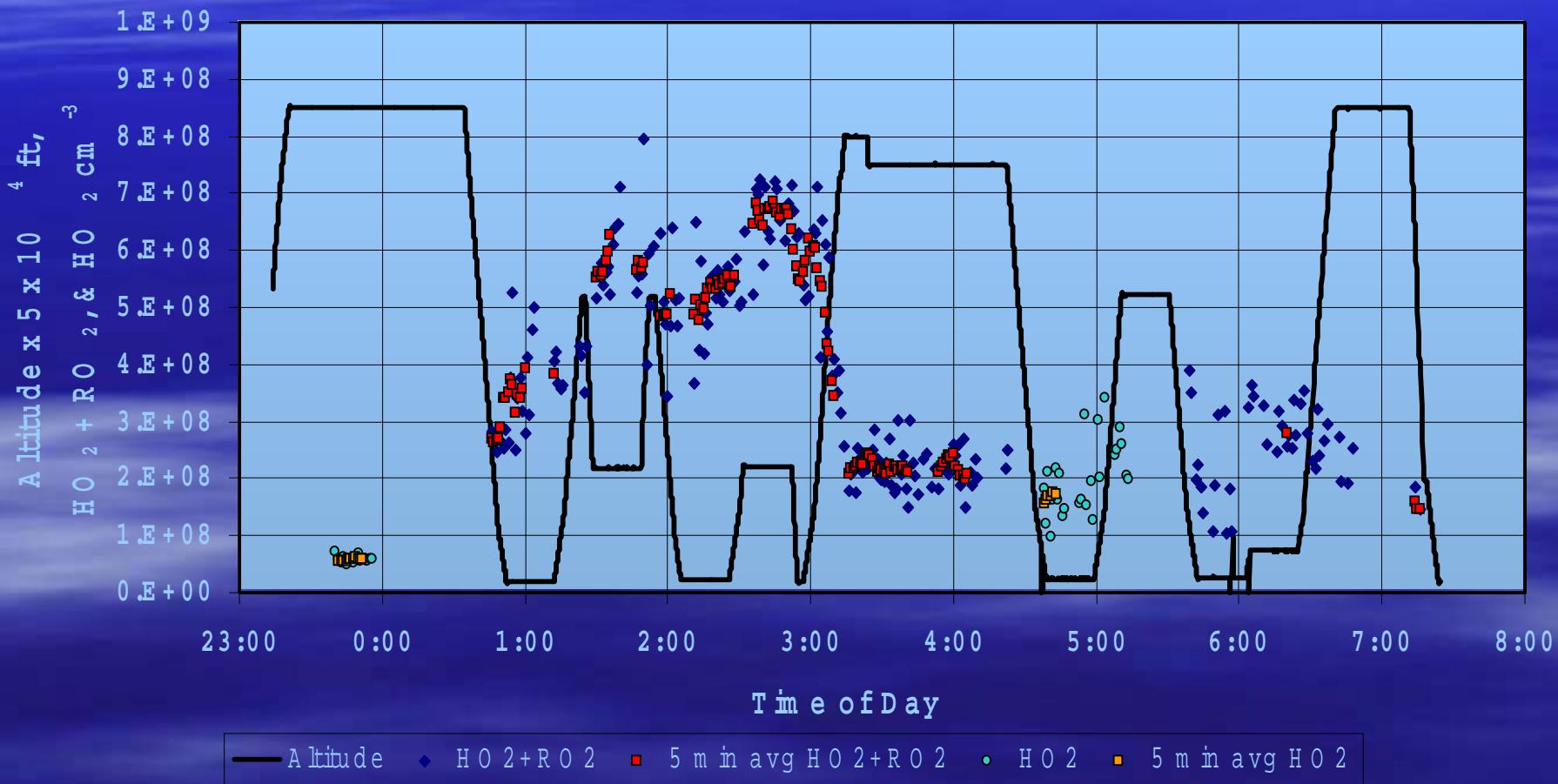


TRACE-P Peroxy Radical data

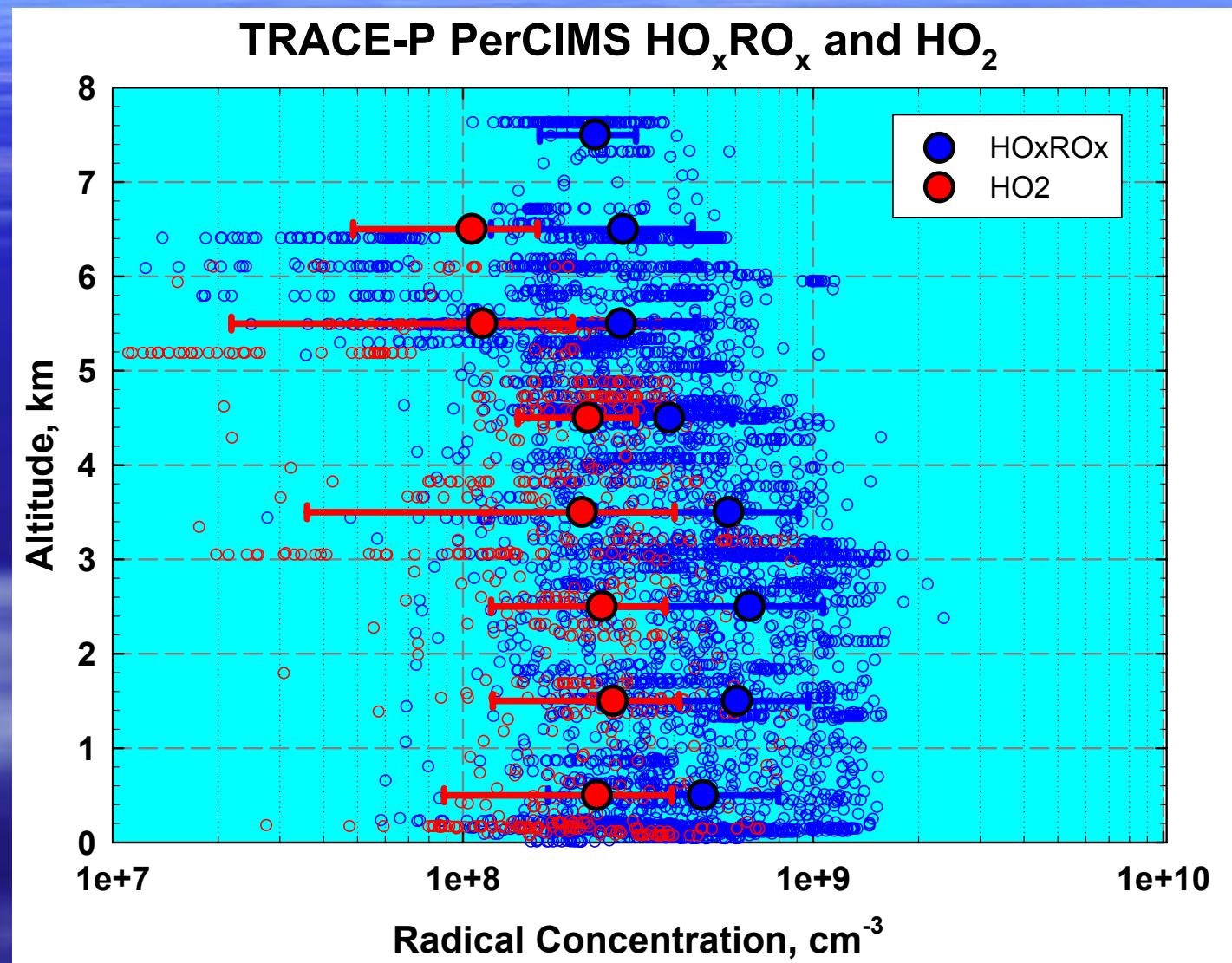
- About 4500 $[\text{HO}_x\text{RO}_x]$ data points
- About 700 $[\text{HO}_2]$ points
- Typical uncertainties 2×10^7 (1-2 pptv) + 30%, but sometimes higher.
- Measured $[\text{HO}_x\text{RO}_x]$ during intercomparisions #1 and #3; attempted $[\text{HO}_2]$ during #2, but instrument had not stabilized.

Data from P3 Flight #16

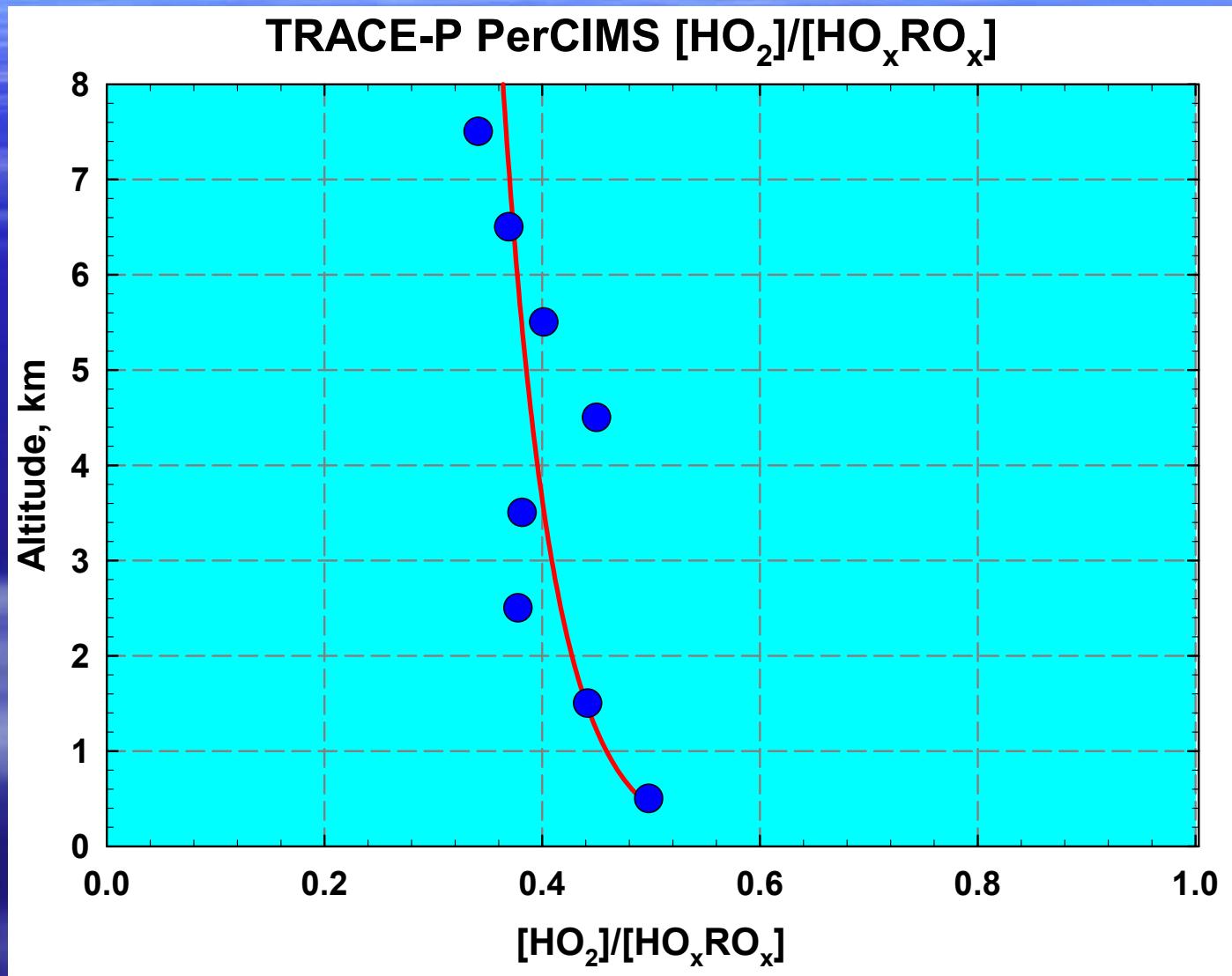
TRACE-P Flight #16
24 March 2001, revised cal
Yokota Local#2



TRACE-P HO_xRO_x and HO₂

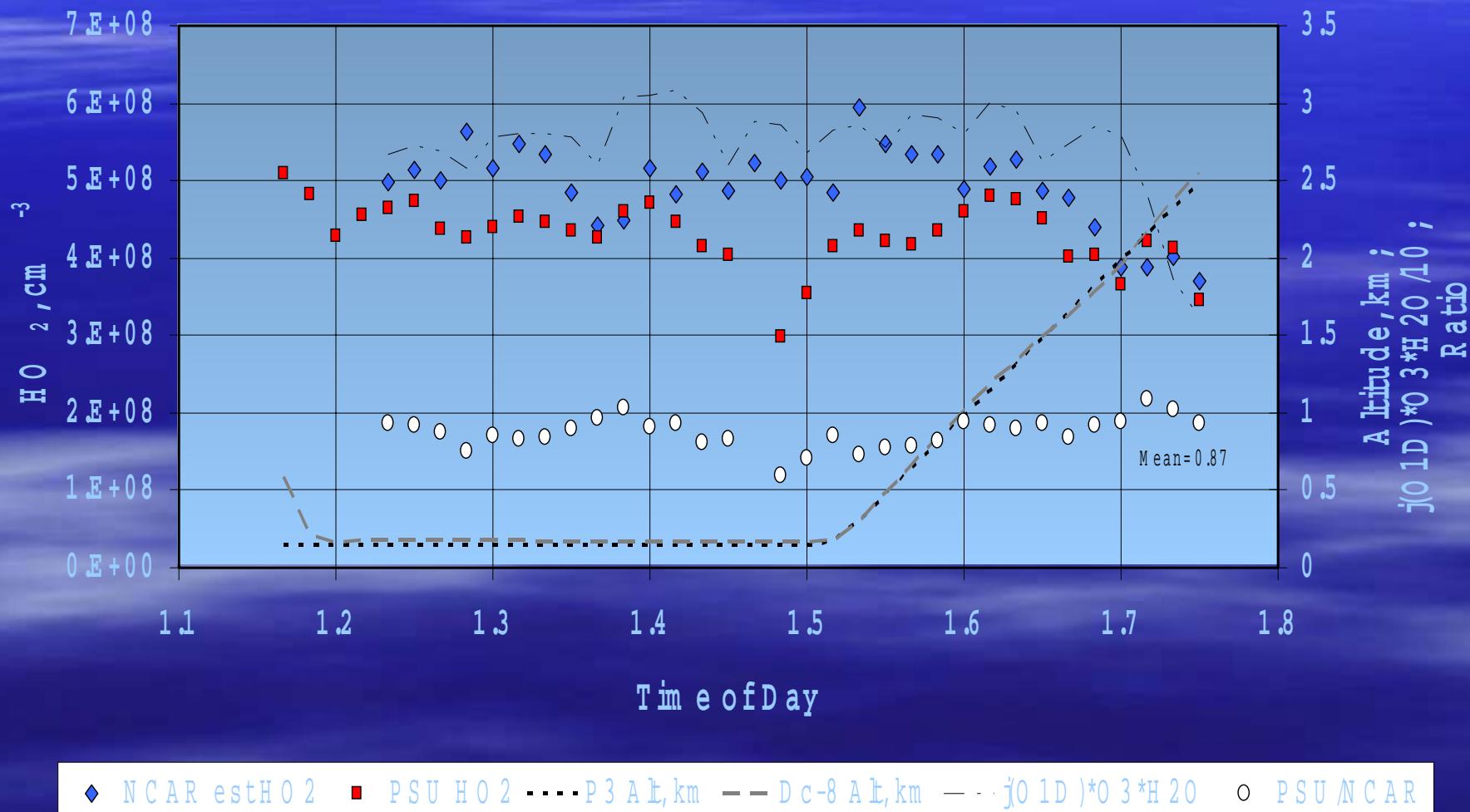


TRACE-P PerCIMS $\text{HO}_2/\text{HO}_x\text{RO}_x$

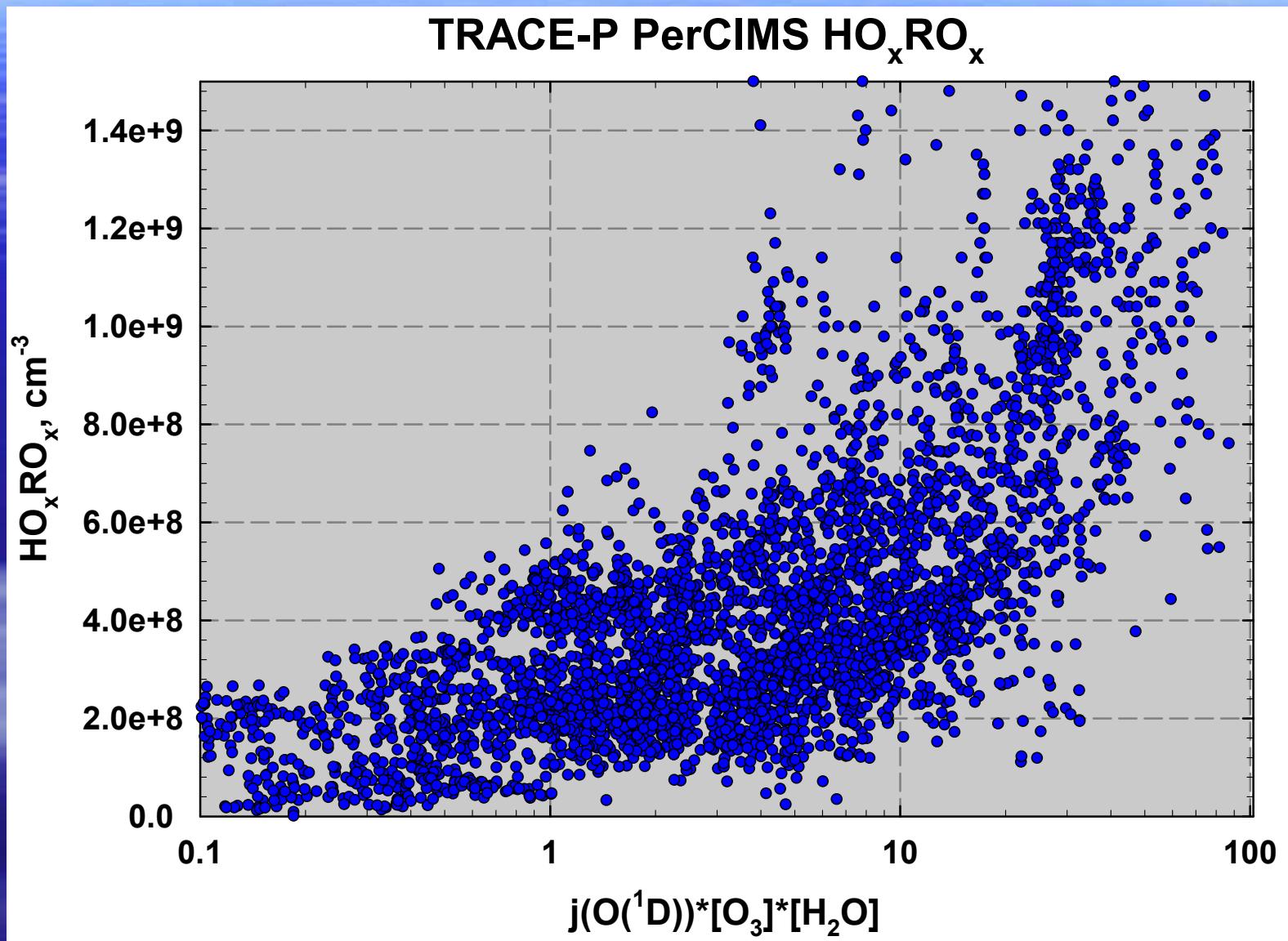


TRACE-P HO₂ Comparison #1

TRACE-P Intercomparison #1

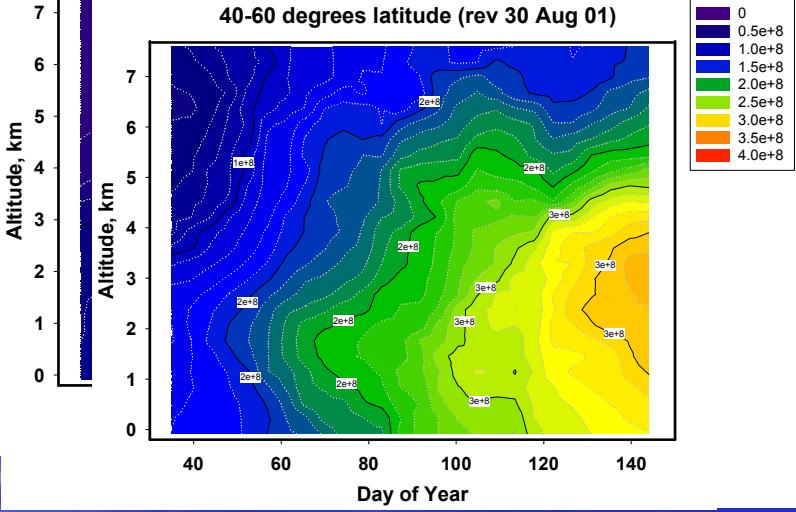


TRACE-P HO_xRO_x vs j*O₃*H₂O

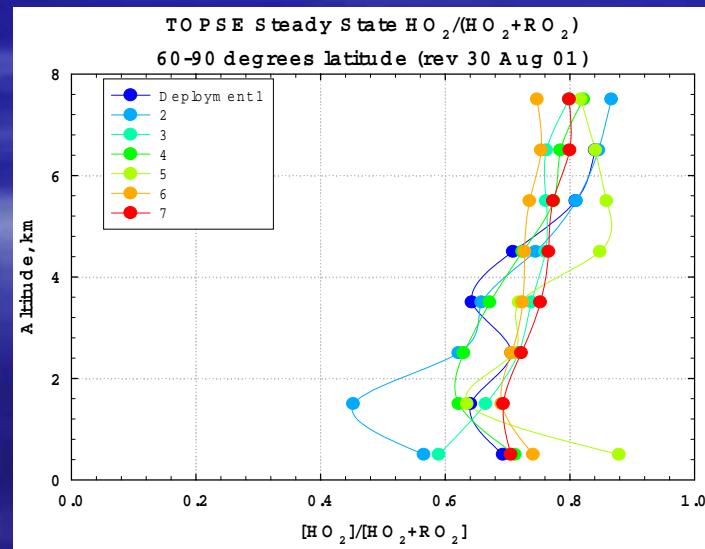


Steady-State Model

- Chemical P = L for OH, HO₂, and RO₂
- Constrained by measured trace gas concentration that appear in P and L terms (CO, NO_x, j-values, HCs, CH₂O, peroxides,...)
- Simultaneously solved using iterative procedure
- Compare ss radical results with measurements
- Derive radical budgets
- Calculate ss values for radical reservoir species
- Examine issues related to ozone photochemistry



of TOPSE Data



Summary

- HO_xRO_x and HO₂ data available on the P3 platform
- Can use these data to learn about radical behavior, budgets and partitioning
- Will apply a simple steady-state model to examine roles of various processes that control radicals and precursors
- Use data to learn something about ozone photochemistry
- Examine role of uptake on cloud droplets and aerosols on peroxy radical levels